

Historic, archived document

Do not assume content reflects current scientific knowledge, policies, or practices.

BUD VARIATION IN PEACHES

By A. D. SHAMEL, *Principal Physiologist*, C. S. POMEROY, *Associate Pomologist*,
and F. N. HARMON, *Junior Pomologist*, *Division of Horticultural Crops and
Diseases, Bureau of Plant Industry*

CONTENTS

	Page		Page
Introduction.....	1	Descriptions of bud variations—Continued.....	
Methods of study.....	2	Phillips Cling Yellow-Section strain.....	15
Descriptions of varieties.....	2	Tuskena Unproductive strain.....	16
Descriptions of bud variations.....	7	Lovell Narrow-Leaf strain.....	16
Sims-Dawson strain.....	7	Peak Narrow-Leaf Early strain.....	17
Sims Early strain.....	10	Peak Wild-Leaf strain.....	18
Lovell Early strain.....	10	Phillips Cling Early strain.....	18
Paloro Early strain.....	13	Improvement of peach varieties through bud	
Phillips Cling Late strain.....	14	selection.....	20
Muir Late strain.....	14	Summary.....	20

INTRODUCTION

A study of peach-bud variations was begun by the senior writer in 1909 in trees of the Belle, Carman, J. H. Hale, and Elberta varieties in the J. H. Hale orchards near South Glastonbury, Conn. For six years individual-tree performance records were kept for plots of about 100 trees of each of the above-named varieties, together with notes of limb variations found in a number of other trees in the same orchards. Selections were made of some of the striking limb variations for propagation tests, and bud wood was cut and supplied to a commercial nursery in order that these tests could be carried out. The failure of this nursery shortly thereafter was followed by the loss of the progeny propagations, and as a consequence this study was discontinued. Evidence was obtained, however, which proved the occurrence of limb variations in some of the trees of the varieties studied. These variations consisted of abnormal fruit or foliage characteristics, and some of them at least were of apparent commercial value.

Later, the discovery of several striking limb variations was reported by George P. Weldon, of the Chaffey Junior College, at Ontario, Calif., and descriptions of some of them were published with the results of progeny tests.¹

In the summer of 1925 two of the writers (Shamel and Pomeroy) began a study of bud variation in peach trees in the 3,900-acre Fancher orchard of the California Packing Corporation located near Merced, Calif. This investigation was undertaken upon the invitation of officials of the corporation and has been conducted without interruption to the present time. The continued interest of these

¹ WELDON, G. P. INSTABILITY IN PEACH VARIETIES. Jour. Heredity 15: 86-90, illus., 1924; 17: 133-135, illus. 1926.

officials, together with the hearty cooperation of the ranch manager and other ranch employees, have made possible a thorough search of the orchards for limb variations, which has resulted in the discovery of a number of striking bud variations. Some of these give promise of considerable commercial value, and all of them are of scientific interest. In addition to the Fancher orchards, individual-tree performance records have been obtained on plots of peach trees of the Lucas Co. (Ltd.), near Cucamonga, Calif., and in orchards owned by Charles Stern & Sons at Mira Loma, Calif.

METHODS OF STUDY

The plan of study adopted includes the accumulation of information as to variety and strain characteristics by means of individual-tree performance records, ascertaining the nature and the frequency of occurrence of bud variations in the trees studied, and the use of progeny-propagation tests in order to determine the extent to which the variations discovered are capable of perpetuation through bud propagation.

The peach varieties used in this investigation include the leading ones grown in the Fancher orchard for canning and drying purposes, such as the Tuskena, Peak, Paloro, Sims, Orange Cling, Libbee, Phillips Cling, Lovell, and Muir, together with varieties that are considered to be more or less experimental and are grown only to a limited extent as yet, including the Sims-Dawson strain and Halford No. 2. The Orange Cling trees were top-worked in 1929 to Halford No. 2, but previous to that time some interesting data had been obtained from a plot of this variety. The Ontario peach, an important variety in southern California, has been studied in an orchard of the Lucas Co. (Ltd.). The following descriptions of the principal peach varieties included in this study are given in order that the variations described may be fully understood.

DESCRIPTIONS OF VARIETIES

Tuskena (Tuscan).—Tree dense, spreading, vigorous; leaves medium size, lanceolate, dark green, crenate, reniform glands; flowers small, pink; fruit medium size, globose, tendency to uneven halves, deep yellow overlaid with dark red, moderately firm yellow flesh with tendency to red streaks out from stone, cling; stone large, red, obovoid, acutely pointed. Heavy regular bearer; season early; used principally for commercial canning.

Paloro.—Tree open, spreading; leaves medium size, lanceolate, dark green, deeply serrate, glandless, flowers small, pink; fruit medium size, globose, deep yellow largely overlaid with red, firm deep-yellow flesh with very slight tendency to red stain around stone, cling; stone medium size, red, oblong ovoid, acutely pointed. Heavy regular bearer; early midseason; used principally for commercial canning.

Peak.—Tree open, spreading; leaves medium size, lanceolate, dark green, deeply serrate, glandless; flowers small, pink; fruit medium size, globose, deep yellow largely overlaid with red, firm deep-yellow flesh with tendency to red stain around stone, cling; stone medium size, red, ovate, acutely pointed. Heavy regular bearer; early midseason; used principally for commercial canning.

Muir.—Tree dense, spreading; leaves medium size, long, lanceolate, light green, crenate, globose glands; flowers small, pink; fruit medium to large size, ovoid, yellow with reddish blush, soft yellow flesh, free; stone small, ovate with long tip, brown. Heavy regular bearer; midseason; largely used for drying and also for canning and dessert.

Lovell.—Tree open, spreading; leaves medium size, lanceolate, dark green, crenate, globose glands; flowers small, pink; fruit medium size, globose, yellow with slight blush, rather soft clear-yellow flesh, free; stone small, roundish-ovoid, acutely pointed, brown. Heavy regular bearer; midseason; largely used for drying and also for canning and dessert.

Orange Cling.—Tree dense, upright; leaves large, broad, lanceolate, dark green, wavy edges and recurved tip, crenate, globose glands; flowers small, pink; fruit large, globose, deep orange with red cheek, firm yellow flesh, cling; stone large, obovoid, wide at base, very thick near apex, acutely pointed, red. Heavy regular bearer; midseason; used for commercial canning.

Gaume.—Tree dense, spreading; leaves large, lanceolate, slate green, crenate, glands reniform with some globose; flowers small, pink; fruit medium size, globose, somewhat flattened at apex, deep yellow largely overlaid with red, firm yellow flesh, cling; stone medium size, oblong, bluntly pointed, brown. Heavy regular bearer; midseason; used for commercial canning.

Johnson.—Tree open, spreading; leaves medium size, lanceolate, light green, crenate, globose glands; flowers small, pink; fruit medium size, globose, deep yellow with light blush, firm yellow flesh, cling. Heavy regular bearer; midseason; used for commercial canning.

Sims.—Tree open, spreading; leaves medium size, long, lanceolate, dull slate green, mostly wavy edges and recurved tip, crenate, reniform glands; flowers small, pink; fruit medium size, globose, deep yellow partly overlaid with red, firm, yellow flesh, cling; stone medium size, oval, acutely pointed, brown. Heavy regular bearer; late midseason; used for commercial canning.

Libbee.—Tree dense, spreading; leaves medium size, lanceolate, dark green, crenate, reniform glands; flowers small, pink; fruit medium size, globose, yellow partly overlaid with red, firm yellow flesh, cling; stone medium size, oval, acutely pointed, red. Heavy regular bearer; late midseason; used for commercial canning.

Phillips Cling.—Tree open, spreading; leaves medium size, lanceolate, narrow, long pointed, light green, crenate, globose glands; flowers small, pink; fruit large, globose, yellow partly overlaid with red, firm yellow flesh, cling; stone medium size, obovoid, acutely pointed, brown. Heavy regular bearer; late season; used more than all other peaches for commercial canning.

Individual-tree performance records have been obtained for a total of 7,397 peach trees in commercial orchards during the course of this investigation. These records consist of an estimate of the quantity of fruit and the percentage of a full crop per tree, with notes of unusual characteristics of size and time of maturity of the fruits and of outstanding foliage characteristics, such as size of tree, type of growth, and kind of leaf glands. Notes have also been obtained describing any abnormal fruit or foliage characteristics observed. A record of the number of trees in the various performance-record plots where these studies are being followed is shown in Table 1.

TABLE 1.—*Peach plots for which individual-tree estimate-production records have been secured*

Location	Variety	Year planted	Trees studied
			<i>Number</i>
Merced, Calif.	Tuskana (Tuscan)	1920, 1921	2,352
	Peak	1921	870
	Paloro	1922	912
	Sims-Dawson strain	1921	55
	Sims	1921	135
	Lovell	1920	125
	Phillips Cling	1920, 1921	360
Cucamonga, Calif.	Ontario	1912	600
	Lovell	1907	600
	Phillips Cling	1907	812
Mira Loma, Calif.	Peak	1919	576
Total			7,397

The trees in each plot have been given numbers consisting of the number of the block or orchard, the number of the row in the plot, and the number of the tree in the row, always counting from some fixed point such as the irrigation head or survey markings.

The estimate-yield data were obtained by an inspection of the crops of each tree just before the fruits were picked. The estimated number of boxes of fruit borne by each tree and the percentage of a full crop for each tree were checked by a comparison of these records with the actual yields of the plots as a whole when the fruits were picked, and they were found to be accurate enough for the purposes of this study. The comparative yields of the individual trees in each plot are considered most important in this work in order to classify the trees according to their high, low, or average performance and to determine the consistency of their yields from year to year. While actual yield records would have been preferable, it was not possible to obtain them in commercial orchards. However, individual-tree picking records are being obtained in the progeny orchards where the trees have been propagated from the selections of striking variations that have been found in the commercial orchards.

In connection with the work of obtaining individual-tree performance records, a systematic search has been carried on for striking limb and entire-tree variations in commercial orchards located near the performance-record plots. In this work it has been found important to learn when, where, and how to look for these variations. For example, in order to find early-ripening variations it is necessary to go through the orchards from two to six weeks before the normal ripening time of the different varieties; and if it is desired to investigate late-ripening variations, the trees should be inspected at the time that the normal fruits ripen in order to distinguish the green ones, or after the crop has been harvested, so that fruits that were too green to be picked at the normal time may be found.

It has been found helpful to train the eye so that abnormal fruits may be recognized when the inspections are made. The limb variations may occur in any location in the trees, so that it is desirable to look the trees over thoroughly. With experience, fruit and foliage variations can be noticed at a glance, when without this training the abnormal conditions may be unobserved.

Workmen in the orchards, irrigators, cultivators, and pruners are invaluable aids in the search for variations, by reason of their constant association with the trees. If these men are taught what to look for during their work, they may discover abnormal limbs and trees. In this investigation orchard workers have brought to the writers' attention some of the most important limb and entire-tree variations that have been found.

In the search for limb or entire-tree variations it is important to distinguish those that are apparently the result of local environmental influences from those that are inherent bud variations. The variations or fluctuations resulting from local soil or cultural influences are not inherent, whereas true bud variations are inherent and capable of perpetuation through bud propagation. While it is impracticable at the present time to determine definitely the nature

of all variations except through progeny tests, with experience it is possible to eliminate, at the time when they are first noticed, most of those that are due to local environmental factors.

A list of the limb and entire-tree variations that have been propagated is presented in Table 2, classified by the most outstanding characters that distinguish them from the normal forms for the variety.

TABLE 2.—*List of limb and entire-tree peach variations that have been propagated for progeny tests, classified according to the outstanding characters that distinguish them from the normal characteristics*

Outstanding characters differing from normal ¹	Limb variations	Entire-tree variations
	Number	Number
Earlier maturity of fruit.....	10	13
Earlier, R to G glands.....	1	4
Earlier, G to R glands.....	1	1
Earlier, G to 0 glands.....	1	1
Earlier, cling to free.....	1	1
Earlier, cling to free, R to G glands.....	1	1
Earlier, cling to free, R to 0 glands.....	1	1
Earlier, cling to free, G to R glands.....	1	1
Earlier, free to cling, R to G glands.....	1	1
Earlier, nectarine, G to 0 glands.....	1	1
Later maturity of fruit.....	3	2
Later, R to G glands.....	2	2
Later, cling to free.....	1	2
Later, cling to free, R to 0 glands.....	1	1
Later, free to cling, R to 0 glands.....	1	1
Abnormal fruits.....	4	5
Unproductive.....	1	1
Narrow leaves.....	1	1
Narrow leaves, earlier maturity of fruit.....	1	1
Narrow leaves, G to 0 glands.....	1	1
Narrow leaves, wild, persistent late.....	5	1
Flat leaves, persistent late.....	1	1
Variegated foliage.....	1	1
	39	31

¹ R indicates reniform, G globose, and 0 glandless. R to G means that the glands of the parent variety being studied were reniform, whereas those of the particular variation were globose.

Progeny propagations of 39 limb and 31 entire-tree variations have been carried out thus far. In each instance four or more progeny trees, together with type trees of the varieties, have been propagated from each of the variations, while in a few instances, including those variations of apparent immediate commercial importance, a much larger number of trees have been grown. The propagations have been made by L. B. Scott, senior pomologist, at the United States Cotton Field Station at Shafter, Calif., and most of the resultant trees have been planted in orchard form at this location, with an additional planting in a progeny-test plot in the Fancher orchard near Merced. These propagations have been made on selected peach rootstocks and are being used by Mr. Scott in a rootstock study at the Shafter station and at the Fancher orchard. Where comparative fruit and foliage results are desired, all the progeny trees from any one parent are on the same rootstock; and where rootstock studies are being carried on, the buds have been selected from some of the apparently commercially valuable variations. A list of the number of limb and entire-tree variations that have been propagated each

year and the number of progeny trees propagated from them is shown in Table 3.

TABLE 3.—Number of peach variations found each season and number of progeny trees propagated from these variations and planted in orchard form for performance tests

Variety	Limb variations found						Entire-tree variations found						Progeny trees propagated from limb variations	Progeny trees propagated from entire-tree variations
	1926	1927	1928	1929	1930	Total	1926	1927	1928	1929	1930	Total		
Tuskana (<i>Tuscan</i>)	2		4			6	2					2	65	20
Ontario		2		1		3						0	12	0
Muir	1	1			1	3		1	1	1		3	28	22
Peak	3		1			4	1			1		2	49	115
Jaloro					1	1			1			1	10	8
Johnson					1	1						0	4	0
Orange Cling						0		1				1	0	9
Lovell	1	1				2	1	1				2	28	19
Gaume	1		1			2						0	18	0
Sims	5	1	1	1		8			1			1	126	120
Libbee			2			2		1	1			2	12	20
Phillips Cling	4		2		1	7	2	3	4	8		17	80	104
Total	17	5	11	2	4	39	4	6	7	6	8	31	435	329

In the case of the limb variations included in this circular there is no question as to their origin through bud variation. The entire-tree variations listed include only those where available evidence indicates that they have probably originated as bud variations. In the commercial orchards, where these studies are being carried on, a large number of off-type trees have been found from time to time. Many of these are commonly believed to be the result of the failure of the inserted buds to grow in the nursery seedlings, followed by the development of the trees from the rootstocks, so that they are of seedling origin rather than from the development of bud variations. It seems likely, however, that in some of the observed instances the abnormal trees are the result of the unintentional propagation of inherent bud variations. The so-called entire-tree variations selected for progeny propagations in this work were such that the writers are of the opinion that they have probably resulted from bud variations, although there is a possibility that they are of seedling origin.

Progeny propagations of limb variations are recorded by assigning a certain number to the parent tree; the bud wood from the normal part of the tree is then given the suffix A, and that from the limb variation is given the suffix B. For example, the Sims-Dawson strain bears the number 1-B, and the normal Sims part of the same tree is 1-A. These numbers are preceded by the initial and final letters of the name of the fruit under consideration, peaches being designated as PH. The complete symbol for the Sims-Dawson strain thus becomes PH-1-B, and PH-1-A indicates the normal Sims propagation from the same parent tree. Copper tags bearing these numbers are attached to the branches from which the bud wood

is taken so that they can be definitely located for observation in later years.

DESCRIPTIONS OF BUD VARIATIONS

In this publication it is impracticable to include a description of all the limb and entire-tree variations that have been found during this investigation. A few of the striking and typical ones have been selected for this purpose to illustrate the nature of the work and to offer definite evidence as to the occurrence and characteristics of striking bud variations in peach trees. It is intended to present in later publications more detailed discussions of these variations with descriptions of many others that are being studied.

SIMS-DAWSON STRAIN

The parent of the Sims-Dawson strain of the Sims peach variety was a limb variation in a Sims tree planted in 1907 by W. A. Sims, sr., in what are now the Edgewood orchards of the California Packing Corporation at Farmersville, Calif. The limb variation was found by Mr. Sims and T. B. Dawson in 1911 as a secondary branch located near the top of an otherwise normal Sims tree (fig. 1), and

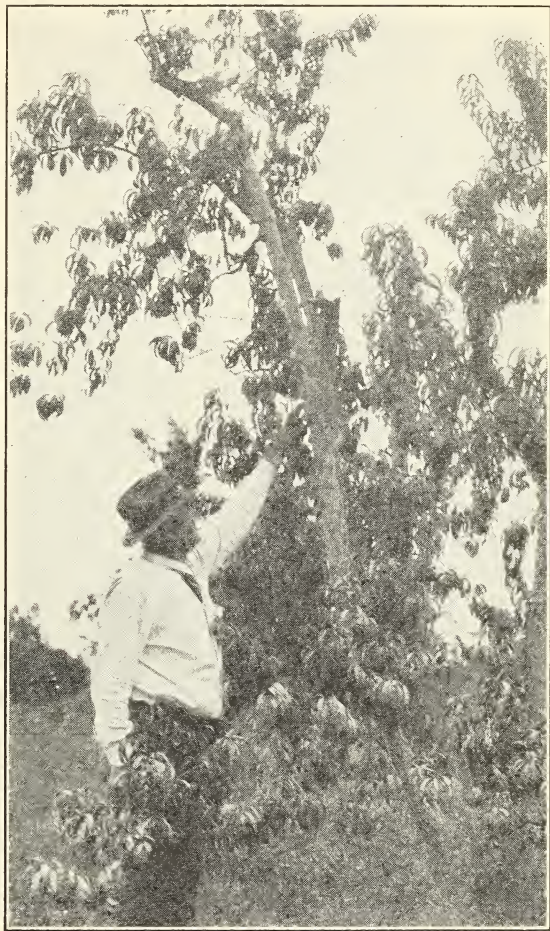


FIGURE 1.—Sims peach tree planted in 1907, showing, at the point indicated, an early limb variation that was found as a secondary branch in 1911. Commercial propagations were made from this limb, and the variation was named Sims-Dawson. Farmersville, Calif., August 24, 1926

it was observed on account of the reddish color of its fruits as contrasted with the green color of the less mature normal peaches borne by the neighboring branches of the same tree. One tree was budded from this limb variation at the time of its discovery, and in 1919 several hundred trees were propagated from it. About 200 progeny

nursery trees from this propagation were set out in the Fancher orchard in 1921, and these are now in full bearing.

On August 24, 1926, the senior writer visited the parent tree in the Edgewood orchard in order to photograph it and to study its characteristics. At that time the Sims-Dawson strain was conspicuous on

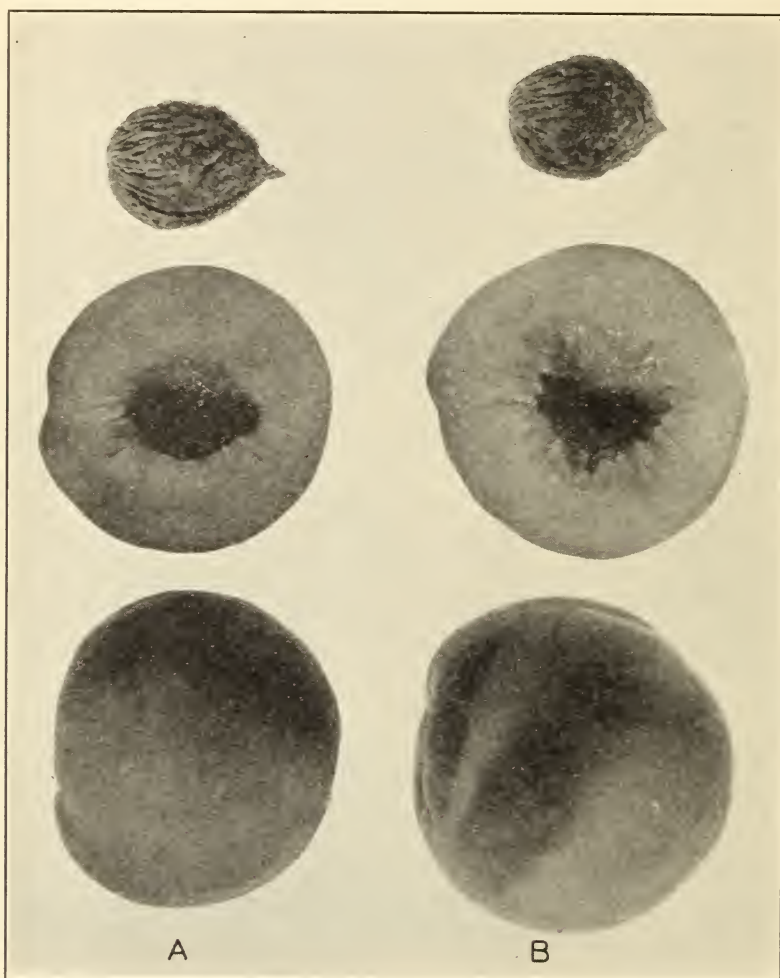


FIGURE 2.—Fruit of the normal Sims peach (A), still immature, and mature fruit of the Sims-Dawson strain (B), produced on progeny trees propagated in 1926, respectively, from a normal branch and from the original Sims-Dawson limb variation in the tree shown in Figure 1. Shafter, Calif., August 8, 1930

account of the bright-red color of its fruits, while the peaches borne by the other branches were just beginning to take on a reddish tinge of color. Bud wood was cut from the limb variation at that time, and a few bud sticks were also cut from the normal part of the same main limb below the variation. These buds were inserted in peach rootstocks in September, 1926, and the dormant-budded trees were

set out in the two experimental progeny orchards at Shafter and Merced, Calif., early in 1927.

The foliage characteristics of the Sims-Dawson strain are apparently very similar to those of the normal Sims, the leaves of both having reniform glands and being of about the same shade of green. The growth of the Sims-Dawson strain trees is somewhat more spreading than is the case with the Sims trees, and in this respect the former more nearly resemble Peak trees.

The Sims-Dawson fruits color and ripen about 7 to 10 days earlier than the normal Sims peaches and are somewhat smaller in size with a more reddish skin color. They resemble more nearly the typical fruits of the Peak variety, and when compared with Peak peaches grown on neighboring trees they are indistinguishable in so far as these studies have gone. They ripen at about the same time as the Peak fruits under observation and have similar texture and color of flesh and about the same size and shape of seed. In fact, in the Fancher orchard the Sims-Dawson fruits are harvested and handled as Peaks. Further observation

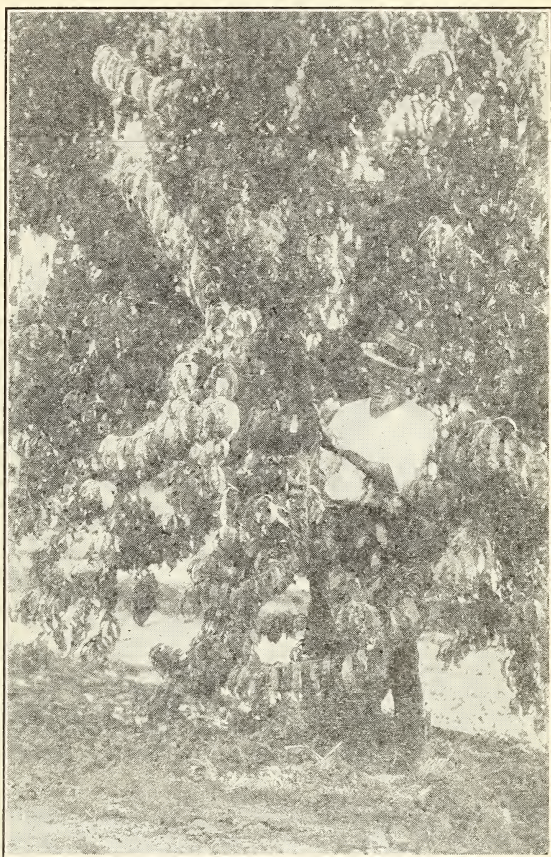


FIGURE 3.—A Sims peach tree planted in 1921, showing a limb variation found in 1926 as the upper portion of one of the main branches (above point indicated by hand), the fruits of which mature about two weeks ahead of the normal fruits on this and other Sims trees. Merced, Calif., August 27, 1926

is necessary before final conclusions can be drawn as to the commercial value of the Sims-Dawson strain of the Sims variety.

The progeny trees of the Sims-Dawson strain and of the normal Sims have fruited, and those of the former have reproduced the characteristics of the parent limb, whereas those from the normal Sims branch of the same parent tree have shown only typical Sims characteristics. Comparable Sims and Sims-Dawson fruits from progeny trees of the propagation made in 1926 are shown in Figure

2. This test proves that the characteristics of the Dawson strain have been perpetuated through budding and that it is a true bud variation.

SIMS EARLY STRAIN

The limb variation designated as the Sims Early strain was found on August 4, 1926, as a secondary branch in an otherwise normal Sims tree (fig. 3) located in block 215 of the Francher orchard of the California Packing Corporation. It was discovered by reason of the bright reddish color of its fruits in contrast with the green peaches on the other branches of the same tree at that date and on other trees in that block. The limb variation arises from one of the main limbs of the parent tree about $2\frac{1}{2}$ feet above the crotch of the tree. Branches bearing normal Sims peaches were found on the main limb below the point of origin of the bud variation. The parent tree was planted in 1921, so that it was nearly 6 years old when the limb variation was first noticed.

Bud wood was cut from the limb variation and from a normal limb of the same tree. The first propagation of this bud wood was made at the Shafter station September 7, 1926, and several similar additional propagations have been made during subsequent years. The resultant progeny trees from the first propagation were planted as dormant-budded trees at Shafter and at Merced during the spring of 1927. Fruits from these trees were harvested during the seasons of 1929 and 1930.

The foliage characteristics of the variation are indistinguishable from the normal Sims foliage so far as they have been observed.

The fruits of this limb variation ripen about two weeks earlier than the normal fruits on the same parent tree or on normal trees grown in the same location. They are clingstones and are similar in size, shape, color, and texture to mature normal fruits and may be classified as early midsummer canning peaches. Tests have proved that the peaches borne by the limb variation are as desirable for canning as the normal Sims fruits, which are of the very highest standard in this respect, and it is possible that they may prove to be superior to the normal Sims for canning on account of an apparently more uniform color and texture of flesh, somewhat better flavor, and possibly a slightly smaller seed.

The performance of the parent limb variation as compared with the normal limbs of the same parent tree has been consistent during the five years since its discovery. The performance records of 1929 and 1930 of the progeny trees that were propagated from the limb variation in comparison with those of the progeny trees propagated from a normal limb prove that the characteristics of the parent limb have been perpetuated through budding. These records indicate that the progeny trees of the Sims Early strain produce as large a quantity of peaches as the comparable progeny trees of the normal Sims variety, if not more. Fruits from these two progenies are shown in Figure 4.

LOVELL EARLY STRAIN

The limb variation designated as the Lovell Early strain was found during the summer of 1927 as one of the main limbs in a tree

located in block 109 of the Fancher orchard. The fruits borne by the limb variation (fig. 5) are similar to normal Lovell peaches except that they mature about two weeks before the normal ones. The limb was discovered by reason of the reddish-yellow color of the ripe fruits as contrasted with the green color of the immature

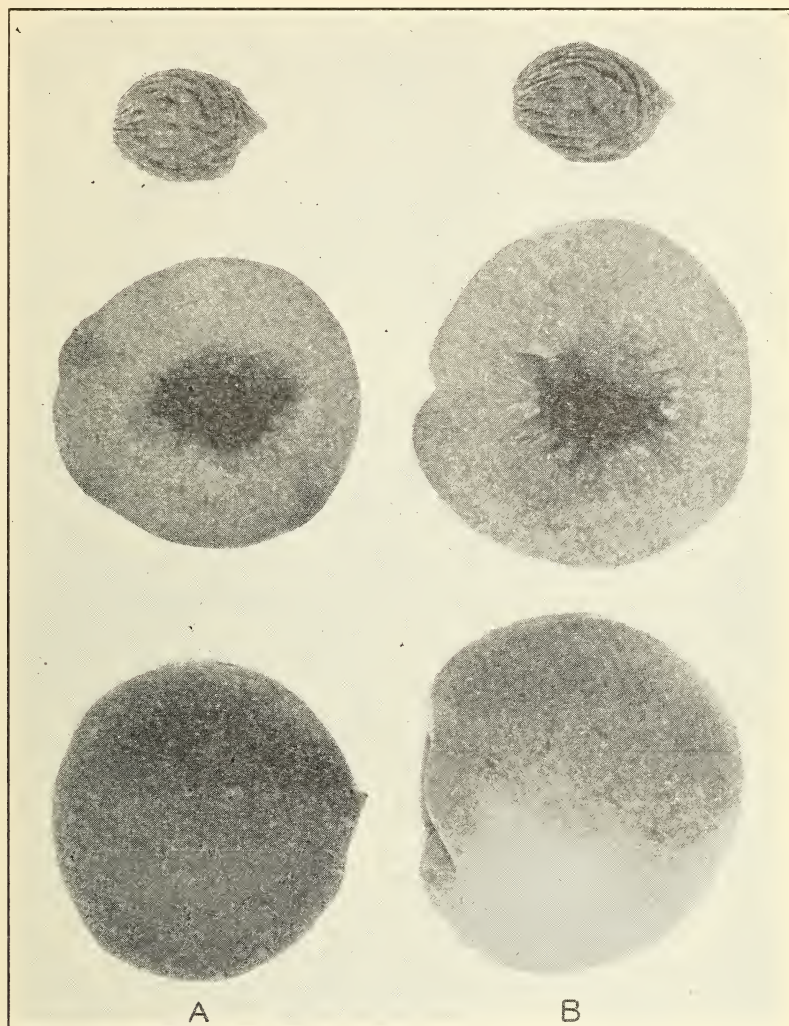


FIGURE 4.—Fruit of the normal Sims peach (A), still immature, and fully ripe fruit of the Sims Early strain (B), produced by progeny trees propagated in 1926, respectively, from a normal branch and from the limb variation in the tree shown in Figure 3. Shafter, Calif., August 8, 1930

fruits on the other limbs of the same tree and on those of near-by trees.

The leaves of the limb variation have globose glands as have the normal leaves, and other foliage characteristics of this limb are apparently normal for the variety. The performance records of the limb variation show that it is equally as productive as the normal

limbs, if not more so, and that the quantity of crop and early ripening characteristics of the fruits have been consistent every year since its discovery. The peaches are freestones, like the normal ones, and are as well adapted for drying purposes as are the normal fruits.

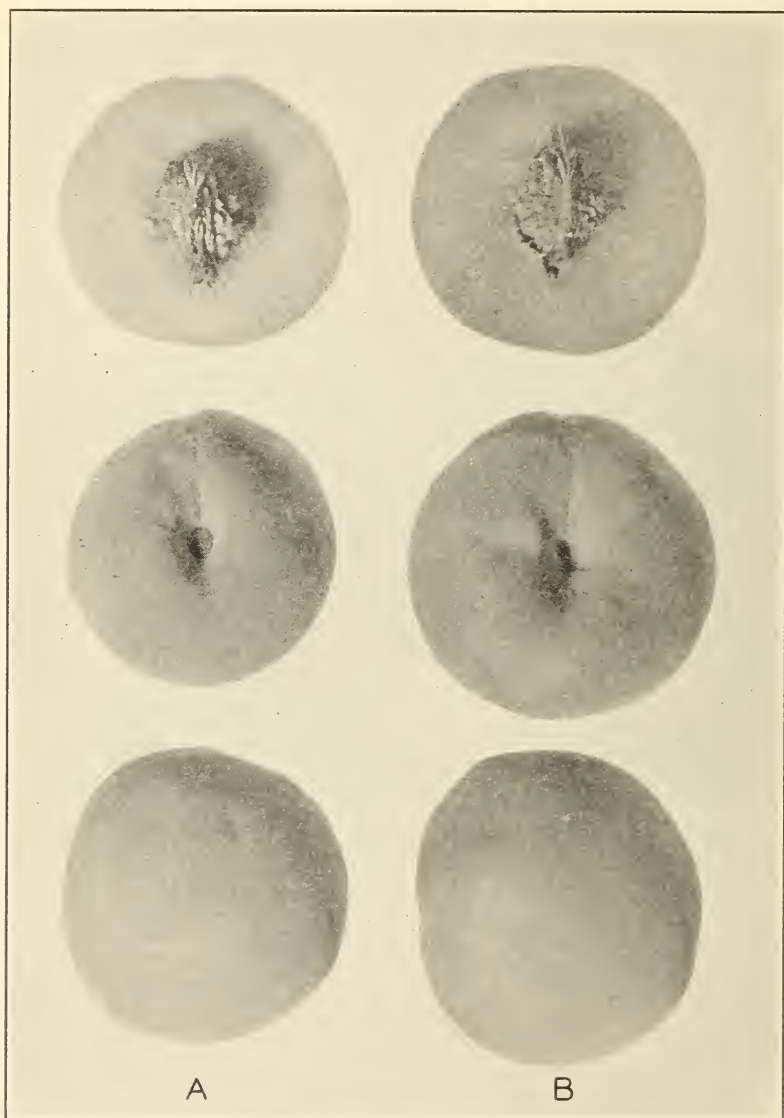


FIGURE 5.—A, Fruit, still immature, from a normal limb of a Lovell peach tree; B, mature fruit from a limb variation in the same tree, on which the fruits ripen 10 to 14 days earlier. Merced, Calif., August 17, 1929

Progeny propagations of the Lovell Early strain and of a normal limb in the same parent tree were made in September, 1927. The resultant progeny trees were planted the following year at the Shafter station and at the Fancher orchard, but as yet no fruits have been borne by these trees.

PALORO EARLY STRAIN

The limb giving rise to the Paloro Early strain was found on July 19, 1930, as a secondary branch arising 3 feet above the main crotch

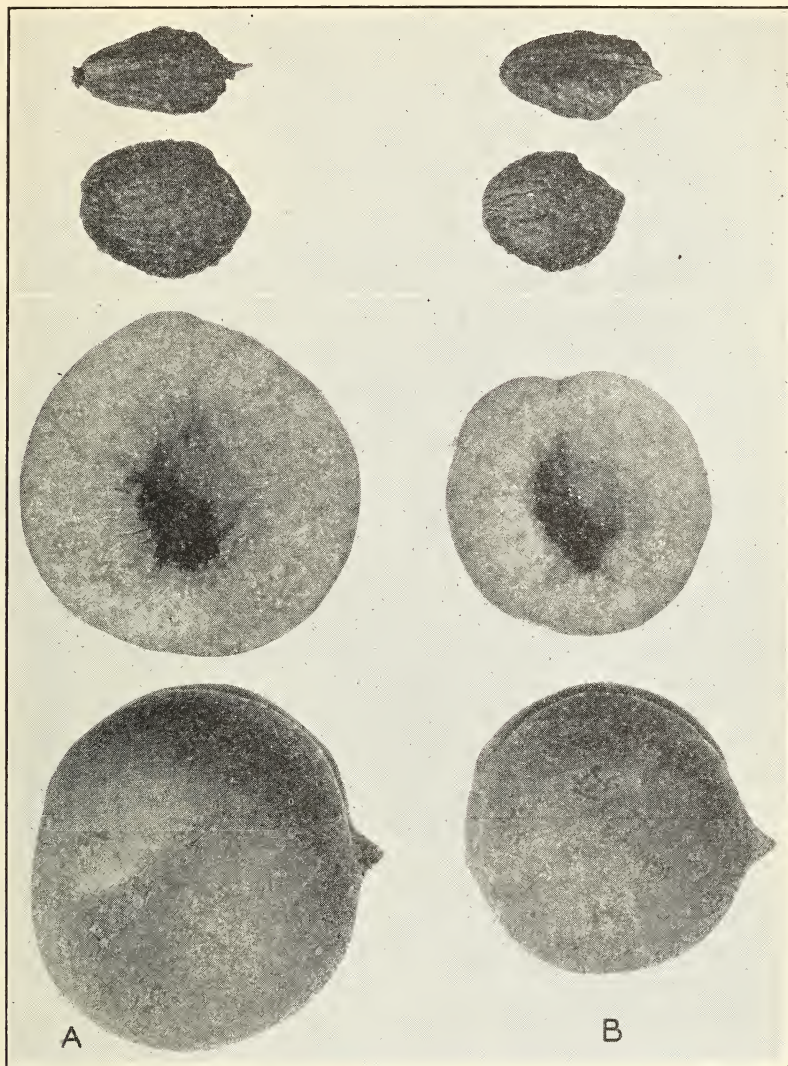


FIGURE 6.—Fruits from a limb bearing normal Phillips Cling peaches that are mature (A) and from a limb variation (B) in the same tree on which the fruit ripens about 10 days later. Merced, Calif., August 29, 1930

in an otherwise normal Paloro peach tree located in block 307 of the Fancher orchard. Like the other early variations, it was noticed by reason of its bright reddish-yellow fruits that were fully ripe, while the fruits on the other branches of the same tree and those on neighboring trees were green and immature. In order to indicate its

earliness, it can be said that the fruits of the Tuskena (*Tuscan*), the earliest commercial canning variety, were not ripe at the Fancher orchard until July 23, 1930, so that the Paloro Early strain peaches were mature at an earlier date than were the Tuskena. This is a very important characteristic, because the Tuskena peach is not completely satisfactory as a commercial canning variety and its use is continued only on account of its earliness. A superior variety ripening as early as the Tuskena would doubtless supersede it in a very short time.

The foliage characteristics of this limb variation are apparently the same as those of the normal Paloro growth. The fruits are very similar in appearance to normal Paloro peaches and apparently are equally valuable for canning purposes.

Progeny propagations of this limb variation and of a normal limb in the same parent tree were made at the Shafter station during September, 1930, and a number of the resulting trees were planted at Shafter and in the Fancher orchards in 1931.

PHILLIPS CLING LATE STRAIN

The limb variation designated as the Phillips Cling Late strain was found in 1926 as one of the main limbs in an otherwise normal Phillips Cling tree located in block 205 of the Fancher orchard. It was noticed on account of its green color and hard, unripe fruits while those borne by the other limbs of the same tree were of the yellow color and soft texture that indicate full maturity. Progeny propagations from this limb variation and from a normal limb of the same parent tree were made in 1926, and the resultant progeny trees were planted at Shafter and Merced during the following year.

The leaves of the limb variation are apparently similar in all respects to normal Phillips Cling leaves.

The fruits borne by the limb variation ripen from 10 to 14 days later than the normal peaches on the other limbs of the same parent tree and are apparently slightly smaller in size than the normal ones. They are clingstones and may be classified as very late canning peaches. Figure 6 shows fruits from this late limb and from the normal part of the same tree.

The performance records of the progeny trees of this limb variation, so far as they have been obtained, prove that the characteristics of the parent limb variation have been perpetuated through bud propagation.

MUIR LATE STRAIN

A limb variation was found in September, 1930, as a secondary branch 2 feet above the main crotch in an otherwise normal Muir tree located in block 108 of the Fancher orchard. The limb was discovered after the Muir crop had been picked, when this limb, heavily loaded with still green, immature fruits, was very conspicuous. The fruits are freestones like normal Muirs and except for their late maturity (about three weeks after normal) are apparently identical with the normal ones.

The leaves of the limb variation have reniform glands like the normal ones and are otherwise similar to the normal foliage.

Progeny propagations were made of the limb variation and of a normal limb on the same parent tree in September, 1930, at the Shafter station. The progeny trees were planted in 1931 at Shafter and in the Fancher orchard.

PHILLIPS CLING YELLOW-SECTION STRAIN

A yellow-section limb variation was found in 1927 in an otherwise normal Phillips Cling tree located in block 206 of the Fancher ranch.

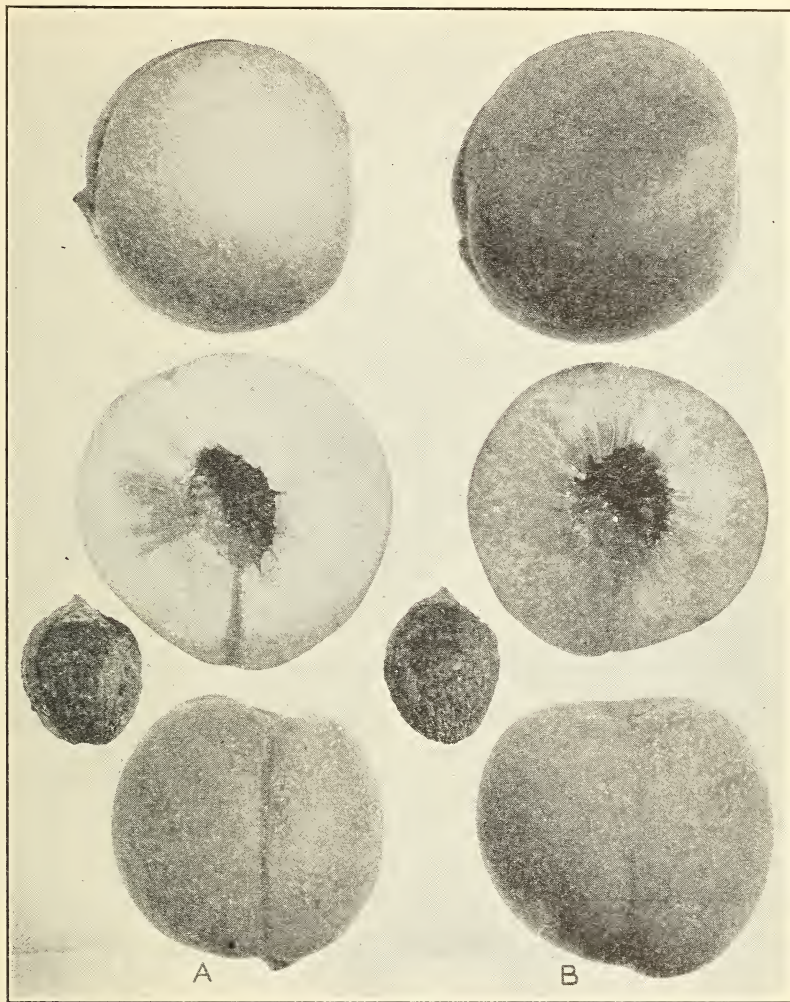


FIGURE 7.—White-fleshed fruits with orange-colored flesh section (A) borne on a limb variation in an otherwise normal Phillips Cling (yellow-fleshed) tree from which the other fruits (B) were taken. Merced, Calif., August 29, 1930

It is the upper part of one of the main limbs, there being two small branches of normal-fruited Phillips Cling from the lower portion of the limb. The most striking characteristic of this variation is that the fruits are white fleshed instead of yellow, with a narrow yellow

section in the suture of the fruit extending from the surface to the pit and from the stem to the tip of the fruit. This section is noticeable in the flesh of the fruits from a very early stage of growth, but on the outside of the peach there is no indication of it until about the time when the fruits ripen. Until then the fruits can be identified only by cutting them. As the peaches mature, a narrow band of brownish-orange color develops on the skin over the colored section, making them easily distinguishable. In shape and size the fruits are apparently normal for the Phillips Cling variety. Fruits from this yellow-section limb and from a normal branch of the same tree are shown in Figure 7.

The leaves of the limb variation have globose glands and are quite similar to the normal Phillips Cling leaves except that they are slightly narrower. From a short distance away it is impossible to distinguish the parent limb variation from the normal limbs of the same tree.

Progeny propagations of this limb variation and of a normal limb in the same tree were made in September, 1928, at the Shafter station. The resultant progeny trees were planted at Shafter and in the Fancher orchard the following year. These trees have not fruited as yet, but the slightly narrower shape of the leaf of the trees from the yellow-section limb variation indicates that its characteristics have been transmitted through bud propagation.

TUSKENA UNPRODUCTIVE STRAIN

The Tuskena Unproductive limb variation was found in an otherwise normal Tuskena (*Tuscan*) tree during the summer of 1928 in block 313 of the Fancher orchard. It constitutes about one-half of the tree from the main crotch, the other half having borne full crops of normal peaches each year since the tree has been under observation. In 1928 the unproductive limb bore only a very few small fruits without pits but of the normal Tuskena color. In later seasons this limb has been entirely barren.

The foliage characteristics of the unproductive limb are apparently identical with those of the normal limbs, and the only distinguishing characteristic observed thus far is the lack of fruits on the unproductive limb.

Progeny propagations were made from the unproductive limb and from a normal limb of the same parent tree in September, 1928. The resultant progeny trees were planted at the Shafter station and in the Fancher orchard the following year. Although none of these has borne any fruit as yet, the characteristics of the parent limb variation are such as to lead the writers to believe that it is a true bud variation.

LOVELL NARROW-LEAF STRAIN

A narrow-leaf limb variation was found in 1925 as one of the five main limbs in a normal Lovell tree located in block 109 of the Fancher orchard. It was discovered by reason of its narrow, sharply pointed leaves as contrasted with the wider leaves of the normal limbs. (Fig. 8.) The leaves of the limb variation are glandless, whereas the normal Lovell leaves have globose glands. About 3 feet above the crotch of this limb variation is found a small branch

with normal Lovell leaves, and narrow-leaf branches grow both below and above this normal-leaf branch.

The fruits borne by the narrow-leaf limb variation are quite similar in all observed characteristics to those produced by the normal limbs. They are freestones, ripening in midsummer, and mainly used for drying. The distinguishing characteristic of the limb variation is its narrow leaves, which are easily observable from a considerable distance.

Progeny propagations of the limb variation as well as of a normal limb of the same parent tree were made at Shafter in 1926, and the resultant progeny trees were planted at Shafter and Merced the following year. The performance of the progeny trees thus far has

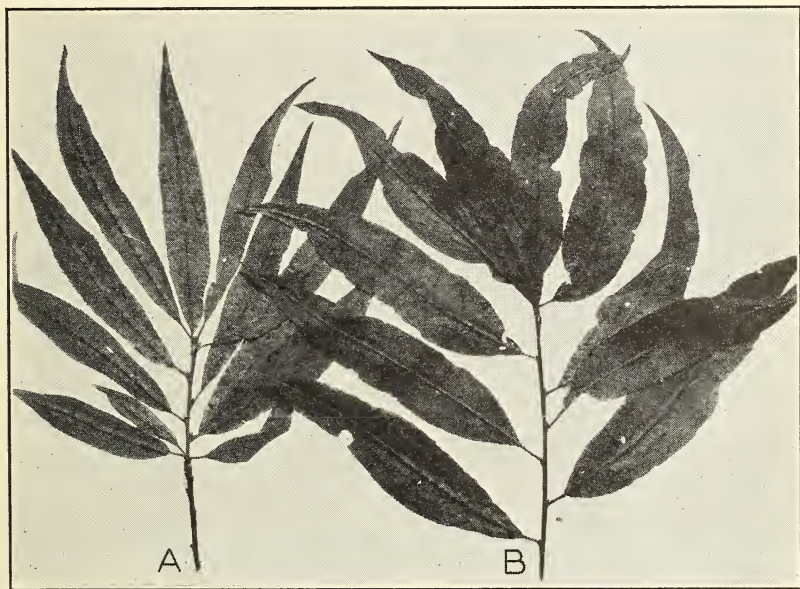


FIGURE 8.—Foliage from a limb variation (A) in a Lovell peach tree, bearing narrow leaves without glands, and from a normal limb (B) in the same tree, with globose glands

proved that the characteristics of the parent limb have been perpetuated through budding with respect to both the narrow and glandless character of the leaves. In several instances the narrow-leaf progeny trees have developed small normal Lovell branches similar to the one found on the parent limb variation.

PEAK NARROW-LEAF EARLY STRAIN

A variation was found in the summer of 1926 as one of the main limbs in an otherwise normal Peak tree located in block 204 of the Fancher orchard. It was discovered by reason of its narrow and rather sharply pointed leaves in contrast with the broader normal Peak leaves on the other limbs of the parent tree. In both instances the leaves are glandless. The fruits of the limb variation are very

similar to the normal Peak peaches except that they ripen about one week earlier.

Progeny propagations of this limb and of a normal limb of the same parent tree were made at the Shafter station in August, 1926. The resultant progeny trees were planted at Shafter and at the Fancher orchard the following year. These trees have not borne fruit as yet, but the narrow-leaf foliage characteristic of the parent limb has been reproduced in the progeny trees, indicating that this is a bud variation capable of perpetuation through bud propagation.

PEAK WILD-LEAF STRAIN

A peculiar foliage variation was found during the summer of 1926 as two small erect-growing branches in the top of an otherwise apparently normal Peak tree located in block 204 of the Fancher orchard. The leaves do not have the drooping habit of growth of normal peach foliage, but stand out at nearly right angles to the branches. They are frequently more or less folded and have sharply pointed ends. (Fig. 9, A.) On account of the unusual habit of growth of the leaves this variation was called "Wild-Leaf." Since the discovery of the first tree having variations of this nature other trees of the Peak variety and trees of other varieties including the Gaume, Sims, and Halford No. 2 have been found in the Fancher orchard that have similar wild-leaf branches. One peculiarity of this variation wherever observed is that the leaves remain green and persist on the branches much later in the fall than do the normal leaves. (Fig. 9, B.) No fruits have been found as yet on wild-leaf branches, but the normal limbs in the same trees have borne normal crops.

Progeny propagations of wild-leaf branch variations in two Peak trees and of normal branches of the same parent trees were made in the fall of 1926, and the resultant progeny trees were planted at the Shafter station and in the Fancher orchard in the following year. The peculiar leaves borne by the progeny trees that were propagated from the wild-leaf variation are very similar to those of the parent-branch variation. These progeny tests prove that the peculiar leaf characteristics of the wild-leaf variations have been perpetuated through bud propagation. The progeny trees have made a rather weak growth, several having died in the orchard during the first year. It is impossible to come to a final conclusion as to the nature of this variation. It has been shown that it can be propagated by ordinary nursery practice.

PHILLIPS CLING EARLY STRAIN

The Phillips Cling Early strain is an interesting example of an entire-tree variation. During a study of the Phillips Cling blocks in the Fancher orchard several abnormal trees have been found that are very similar in all leaf and fruit characteristics. They are more productive than normal Phillips Cling trees and have a particularly strong, spreading habit of growth. The leaves have globose glands, as do normal Phillips Cling leaves. The fruits are apparently identical with normal Phillips Cling peaches, except that they ripen about one week earlier, are not so susceptible to gumming and malformation, and their pits are red instead of brown. The first tree of this



FIGURE 9.—Part of a progeny tree of the Peak Wild-Leaf strain at Shafter, Calif.: A, Branches at the left showing the peculiar foliage of this variation, while at the right and in the center (see arrow) are branches that have reverted to the normal character of foliage; B, the same view on December 18, 1930, when the wild-leaf branches are still carrying many leaves even after a number of frosts, while the normal branches have been devoid of leaves for several weeks

variation was found in block 306 during the summer of 1927. A second tree of the same character was found in block 501 in the summer of 1929, and in 1930 four more similar trees were found in block 306 and two additional ones in block 501. Progeny propagations of all of these trees were made at the Shafter station the same year that they were found, and the resultant progeny trees were planted at the Shafter station and in the Fancher orchard.

The location and the characteristics of these trees indicate that they are the result of the accidental propagation of early-ripening bud variations of the Phillips Cling variety, though they may be of seedling origin. From a study of their performance it seems probable that they may prove to be of commercial value in the development of a superior strain of this important canning peach, from both the production and the canning standpoints.

IMPROVEMENT OF PEACH VARIETIES THROUGH BUD SELECTION

The term "improvement of peach varieties" is used here to mean the development of improved strains of the proved commercial varieties through the isolation and propagation of bud variations that are superior to the parent varieties in one or more characteristics.

The early-ripening and late-ripening bud variations of standard commercial canning varieties found during the course of these studies and the performance of the progeny trees that have been propagated from them indicate the probability that desirable early-maturing and late-maturing strains can be developed from these or similar variations. This achievement will result in the spreading of the picking and canning season of the best varieties over a longer period, with consequent important economic advantages to both the growers and the canners.

The bud variations having better shape, size, texture, and color of fruits than the normal ones of the parent varieties, or those with smaller pits and less or no brownish or reddish-colored flesh surrounding them, are of probable superior commercial value from both the canning and the production points of view.

In the propagation of commercial varieties buds should be obtained only from trees that have been found to bear consistently good crops over a period of years and where the uniformly superior commercial qualities of the fruits in each selected tree indicate its inherent stability and its suitability for propagation.

All of the 70 peach variations found in these studies and now under progeny tests are of scientific interest. The results of the investigations of these variations are expected to add valuable information to present knowledge of the characteristics of the varieties and their variations. Enough evidence has been obtained to warrant the statement that improved strains of peach varieties can be developed through selection of desirable bud variations.

SUMMARY

A scientific study of bud variation in the trees of several important canning varieties of peaches was begun in 1925 and has been continued to the present time. These studies include annual individual-tree performance records in plots where the cultural and other conditions seem most favorable for this work. A systematic effort

is being made to determine varietal characteristics by means of estimate-yield records, together with careful notes and illustrations of outstanding foliage and fruit characters.

A search for striking variations is being carried on, particularly in the Fancher orchard of the California Packing Corporation located near Merced, Calif. Up to this time 70 marked limb and entire-tree variations have been found and are under investigation. It has been demonstrated that striking bud variations occur more frequently in peach trees than has ordinarily been thought to be the case.

Progeny tests of the variations are being conducted at the United States Cotton Field Station at Shafter, Calif., and in the Fancher orchard. Comparative progeny propagations have been made of the variations and of the normal growth in each instance. All the limb and entire-tree variations are of scientific interest, and some of them are probably of commercial value.

Careful selection of bud wood in peach-tree propagation is recommended. Individual-tree performance records showing the quantity and commercial quality of fruit produced by the trees over a period of years is a desirable basis for the selection of parent trees from which to propagate.

It seems probable that improved strains for commercial use will be developed from some of the variations that have been briefly described in this circular. It is believed that canning peaches can be improved through the isolation and development of superior strains of the existing varieties originating from bud variations.

An attempt is being made to interest growers in the phenomenon of bud variation and to encourage them to search for striking variations in their own orchards. In the beginning it is important to learn how, when, and where to look. Progeny tests of apparently important variations will determine whether or not they can be perpetuated through bud propagation and will give definite information as to their commercial value.

ORGANIZATION OF THE UNITED STATES DEPARTMENT OF AGRICULTURE
WHEN THIS PUBLICATION WAS LAST PRINTED

<i>Secretary of Agriculture</i> _____	ARTHUR M. HYDE.
<i>Assistant Secretary</i> _____	R. W. DUNLAP.
<i>Director of Scientific Work</i> _____	A. F. WOODS.
<i>Director of Regulatory Work</i> _____	WALTER G. CAMPBELL.
<i>Director of Extension Work</i> _____	C. W. WARBURTON.
<i>Director of Personnel and Business Administration.</i>	W. W. STOCKBERGER.
<i>Director of Information</i> _____	M. S. EISENHOWER.
<i>Solicitor</i> _____	E. L. MARSHALL.
<i>Weather Bureau</i> _____	CHARLES F. MARVIN, <i>Chief.</i>
<i>Bureau of Animal Industry</i> _____	JOHN R. MOHLER, <i>Chief.</i>
<i>Bureau of Dairy Industry</i> _____	O. E. REED, <i>Chief.</i>
<i>Bureau of Plant Industry</i> _____	WILLIAM A. TAYLOR, <i>Chief.</i>
<i>Forest Service</i> _____	R. Y. STUART, <i>Chief.</i>
<i>Bureau of Chemistry and Soils</i> _____	H. G. KNIGHT, <i>Chief.</i>
<i>Bureau of Entomology</i> _____	C. L. MARLATT, <i>Chief.</i>
<i>Bureau of Biological Survey</i> _____	PAUL G. REDINGTON, <i>Chief.</i>
<i>Bureau of Public Roads</i> _____	THOMAS H. MACDONALD, <i>Chief.</i>
<i>Bureau of Agricultural Engineering</i> _____	S. H. MCCORMY, <i>Chief.</i>
<i>Bureau of Agricultural Economics</i> _____	NILS A. OLSEN, <i>Chief.</i>
<i>Bureau of Home Economics</i> _____	LOUISE STANLEY, <i>Chief.</i>
<i>Plant Quarantine and Control Administration</i> _____	LEE A. STRONG, <i>Chief.</i>
<i>Grain Futures Administration</i> _____	J. W. T. DUVEL, <i>Chief.</i>
<i>Food and Drug Administration</i> _____	WALTER G. CAMPBELL, <i>Director of Regulatory Work, in Charge.</i>
<i>Office of Experiment Stations</i> _____	JAMES T. JARDINE, <i>Chief.</i>
<i>Office of Cooperative Extension Work</i> _____	C. B. SMITH, <i>Chief.</i>
<i>Library</i> _____	CLARIBEL R. BARNETT, <i>Librarian.</i>

This circular is a contribution from

<i>Bureau of Plant Industry</i> _____	WILLIAM A. TAYLOR, <i>Chief.</i>
<i>Division of Horticultural Crops and Diseases.</i>	E. C. AUCHTER, <i>Principal Horticulturist, in Charge.</i>

NATIONAL AGRICULTURAL LIBRARY



1022831630